THE EFFECTS OF RAINFALL ON THE ABUNDANCE AND SPECIES RICHNESS OF SMALL VERTEBRATES IN THE STIRLING RANGE NATIONAL PARK

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ABSTRACT

A pit-trap survey was conducted in mallee scrub from December 1986 to September 1990 within the Stirling Range National Park. Pits were opened for 8 days and 7 nights at the beginning of each month.

The first eighteen months of the survey were conducted under drought conditions and capture rates and number of species were low. Following the drought a marked increase in species richness and capture rates occurred. Frogs increased from two species pre drought to eight species after the drought. Reptiles increased from eight species pre drought to sixteen species post drought and mammals increased by one species after the drought to a total of five.

Of the twenty nine species of small vertebrate captured during this study, two species of frogs (*Heleioporus albopunctatus* and *Neobatrachus pelobatoides*), three species of reptiles (*Morethia obscura*, *Tiliqua rugosa* and *Pogona minor*) and one species of mammal (*Sminthopsis griseoventer*) had not been previously recorded in the Stirling Range National Park.

INTRODUCTION

The Stirling Range National Park covers an area of 115,671 ha and is situated geographically between the wetter South West and the drier Wheatbelt regions of Western Australia, 70km north of Albany. A comprehensive overview of the physical and biological characteristics of the Stirling Range is given in Thomson *et al* (1993), and only a very brief summary is presented here. The park experiences warm dry summers and cold wet winters with snow occasionally falling on the peaks during winter and spring.

Vegetation consists of Mallee scrub, *Eucalyptus marginata* scrub, *Eucalyptus wandoo* woodlands, mountain gullies of *Eucalyptus marginata* and *Eucalyptus calophylla* with a thick understorey and mountain scrub thickets.

The species richness of the Stirling Range was recognised by zoologist J T Tunney, A W Milligan and F L Whitlock in the early 1900's. It was not until 1984 however that a biological survey of the Stirling Range National Park by G Harold was undertaken. This brief survey

(two weeks trapping twice in the year), concentrated mainly on small mammals but gave an indication of the abundance and species richness in parts of the Stirling Range National Park.

The current survey was carried out to examine abundance and species richness of small vertebrate fauna occurring in mallee scrub habitat, especially in relation to season and climatic variability.

METHODS

Pit-traps consisted of plastic buckets 300mm in dia. by 400mm deep and sunk into the ground with tops at ground level. A 400mm high flywire fence was run across the middle of the buckets at ground level. This then formed a line.

Survey methods improved over the first 18 months, as two additional lines were added at both sites. After the additions Site A had three lines (each 10 metres long), consisting of two lines with two buckets and the third line having five buckets in a T shape. Buckets in the T were positioned three across the top of the T and two along the downward section, giving a line 10 metres by 5 metres respectively.

Each of the three lines at Site B were 10 metres long with three buckets per line.

Pits were opened at the beginning of each month for 7 days and 8 nights (on most occasions) from December 1986 to September 1990, giving a total of 3327 pit-trap nights (543 in drought conditions and 2784 after the drought).

Animals were not marked until six months before the end of the survey, so total numbers given/ trapped are not a true indication of population levels. Exception to this was *Mus domesticus* which were killed after measuring and weighing.

SURVEY AREA AND VEGETATION

Two survey areas were chosen near the junction of Bluff Knoll and Chester Pass Roads at the northern boundary of the park.

Sites A and B were 700 metres apart and dissimilar in vegetation, soil types and fuel ages. Soils at Site A consisted of grey sands while Site B had clayey sand 30cm in depth with solid clay and small sandstone rocks interspersed on the surface.

Vegetation at site A consisted of *Melaleuca pungens, Lambertia inermis, Eucalyptus tetragona,* scattered trees of *Banksia attenuata* and occasional *Nuytsia floribunda, Adenanthos cuneata, Dryandra sessilis* and *Eucalyptus pachyloma. Dryandra tenuifolia* and *Xanthorrhoea preissii* were common on the perimeter and *Eucalyptus marginata* bordered the northern side.

Vegetation at Site B was of two ages, with one pit-line in scrub burnt in 1972 (19 years old) east of the firebreak and the other two pit-lines west of the firebreak in an unknown fuel age (estimated at 50 years plus). Vegetation in the 19 year old fuel was open and consisted of *Lambertia inermis, Eucalyptus pachyloma, Calothamnus lateralis* and *Dryandra tenuifolia.* The unknown fuel age at the other two pit-lines was open with mature plants of *Eucalyptus tetragona, Dryandra*

Table 1. During and Post Drought Numbers For Mammals, Reptiles and Amphibians Stirling Range National Park

Species	Numbers	
	Drought	Post Drought
Mammals		
* *Sminthopsis griseoventer*	1	8
Cercartetus concinnus	1	37
Tarsipes rostratus	20	250
Pseudomys albocinereus	1	0
Mus domesticus	0	41
	23	336
Reptiles		
Ramphotyphlops australis	0	2
Cryptoblepharus virgatus	0	1
Ctenotus impar	1	18
Hemiergis peronii	2	6
Leiolopisma trilineatum	1	2
Lerista distinguenda	3	29
Menetia greyii	1	3
* *Morethia obscura*	5	16
* *Tiliqua rugosa*	1	2
* *Pogona minor*	0	3
Tympanocryptis adelaidensis	0	1
Varanus rosenbergi	0	3
Aprasia pulchella	2	11
Delma australis	0	1
Diplodactylus spinigerus	0	3
Phyllodactylus marmoratus	2	10
	18	111
Amphibians		
Crinia georgiana	0	2
* *Heleioporus albopunctatus*	12	9
Limnodynastes dorsalis	2	29
Litoria adelaidensis	0	1
Myobatrachus gouldii	0	52
* *Neobatrachus pelobatoides*	0	1
* *Neobatrachus albipes*	0	3
Pseudophryne guentheri	0	110
Unidentified frogs	1	20
	15	227

* Not recorded prior to this survey

tenuifolia, Hakea lissocarpha, Xanthorrhoea preissii, Isopogon buxifolia, Dryandra armata and other small shrubs.

Both sites are similar to much of the mallee plains that occur in the Stirling Range National Park, with very few areas that have been unburnt for thirty or more years.

RESULTS

The first eighteen months of trapping (December 1986 to April 1988) were conducted under drought conditions with 320 millimetres of rain in 1987 (the driest year on record), while the remaining three years (1988, 1989 and 1990) had average to above average rainfall, with 1988 (666 millimetres), the wettest year on record. Average rainfall for the Bluff Knoll residence (700 metres from the study site) over fifteen years from 1976 to 1990 is 499.8 millimetres.

The drought broke on the second of May 1988 with 170 millimetres of rain falling over four days.

Eight frog, sixteen reptile and five mammal species were captured during the four year survey. These are listed in Table 1 along with during and post-drought numbers.

Capture rates during this drought were very low to nil, with a total of 14 frogs in two genera, 23 mammals in four genera and 18 reptiles in nine genera. The ground burrowing frog *Pseudophryne guentheri* was not recorded during the drought but two nights after the drought broke, in May 1988, single specimens were recorded at Site B and the following night at Site A. An unidentified Heleioporus species, not recorded during the drought, was captured six nights after the break of the drought at Sites A and B.

Of the seven frog species recorded only two (*Heleioporus albopunctatus* and *Lymnodynastes dorsalis*) were active during the drought. Following the drought four species, *Pseudophryne guentheri, Myobatrachus gouldii, Lymnodynastes dorsalis and Heleioporus albopunctatus,* were frequently active on the surface, with *Pseudophryne guentheri* very common. *Crinia georgiana, Neobatrachus pelobatoides, Neobatrachus albipes* and *Litoria adelaidensis* were rarely captured with only a total of seven captures recorded after the drought. *Heleioporus albopunctatus* was the only frog that did not increase after the drought, with 12 captured pre and 9 post drought.

Nine species of reptiles were recorded during the drought totalling eighteen individuals, with *Morethia obscura* being recorded most frequently (five occasions). Post drought a further seven reptile species were recorded and an increase in total captures to one hundred and eleven, with four species *Lerista distinguenda, Ctenotus impar, Morethia obscura and Aprasia pulchella* recorded on twenty nine, eighteen, sixteen and eleven times respectively. Many reptiles were captured on only a few occasions (refer Table 1).

Of the five mammal species, *Tarsipes rostratus* was most commonly caught with a total of 270 recordings, with drought numbers well down (20) compared with post drought (250) (Fig. 1). Both sites recorded similar capture rates. Numbers of *Cercartetus* trapped also

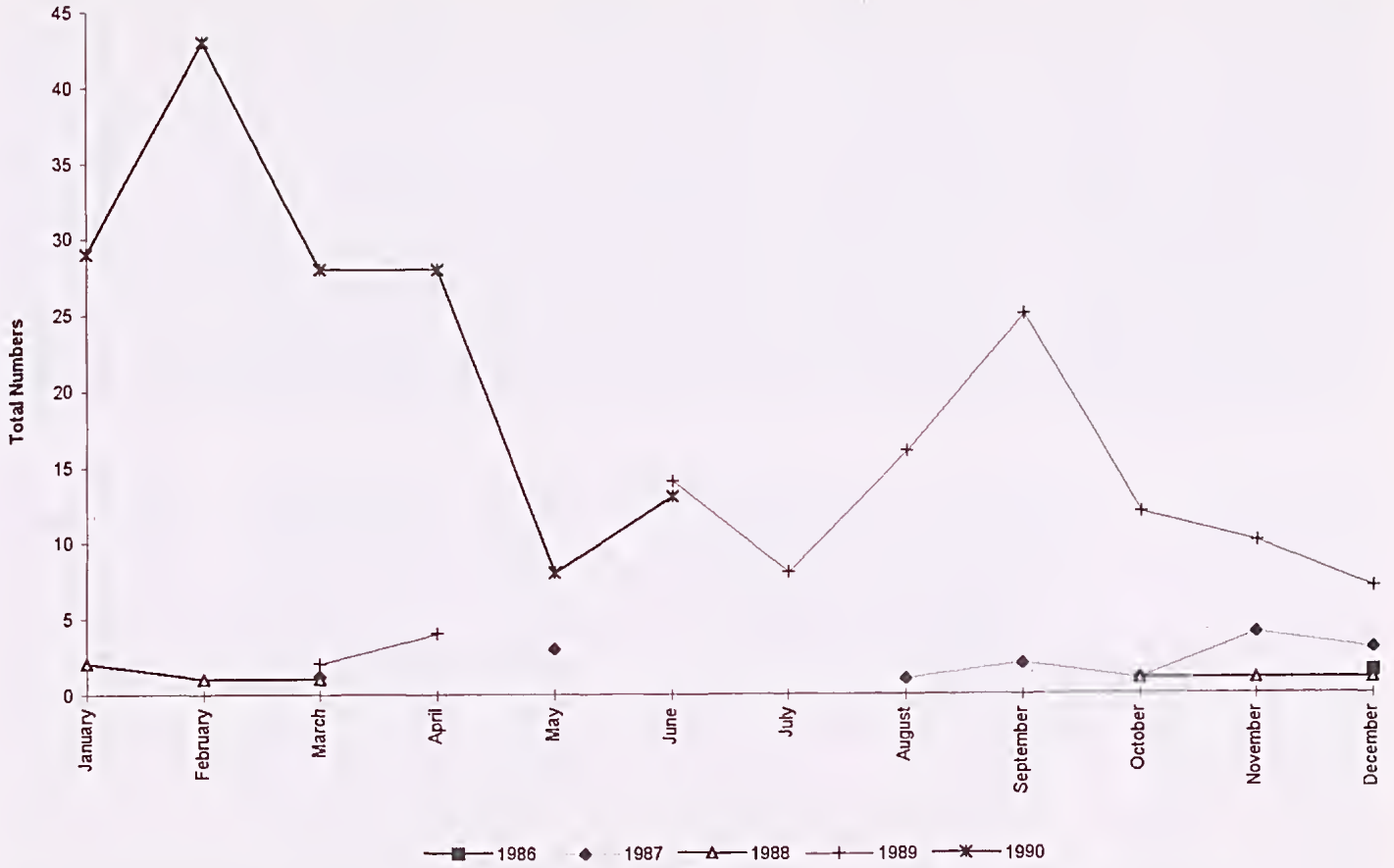

Figure 1. Capture Rates for *Tarsipes rostratus* from December 1986 to September 1990, Stirling Range National Park.

increased markedly after the break of drought.

Sminthopsis griseoventer was not recorded in the Stirling Range National Park until a male was caught on the 6 June 1988 at Site B and later identified by the Western Australian Museum.

DISCUSSION

During this study, with one exception (*Heleioporus*), all species for which there were more than 10 captures were trapped markedly more frequently after the break of drought.

The effect of drought on species numbers can be clearly demonstrated by comparing during and post drought figures for the Honey Possum (*Tarsipes rostratus*), a common species in the park. A single fence line with 3 pits at Site A captured 13 *Tarsipes rostratus* during December 1986 to April 1988 when 379 millimetres of rain fell. The same three pits captured 53 Tarsipes after the drought (December 1988 to April 1990) when 766 millimetres of rain fell.

Myobatrachus gouldii, not captured during the drought and not as common as *Pseudophryne guentheri*, was captured on 17 occasions at Site A and 35 at Site B. The harder soils at Site B may have been more favourable for burrowing than the softer sandy soils at Site A.

While *Pseudophryne guentheri*, *Neobatrachus albipes* and *Myobatrachus gouldii* were captured for the first times just after the drought broke, it was not until 6 months later that a marked increase in most species occurred. Capture rates increased and peaked in April 1989 (11 months after the drought broke), when 99 individual species (34 Site A, 65 Site B) were captured. A levelling out of capture rates for each month was then experienced, but still above drought figures.

Average to above average rainfall stimulates plant growth resulting in prolific flowering. Animals may respond to factors including this succulent growth and prolific flowering by either commencing breeding or survival rates are higher. In a three year study of 5 Scincid lizards (*Ctenotus*) in Central Australia (James, C.D. 1991), reproductive activity was higher during the second year as a result of higher rainfall.

Heleioporus albopunctatus, a large burrowing frog, would appear not to be affected by drought as it was captured on 12 occasions pre and 9 post drought. *Pseudophryne guentheri* not captured during the drought was common post drought with 110 captured, this being twice as many as the other seven species of frogs (see Table 1).

Several between site differences were also observed. *Sminthopsis griseoventer* preferred the sandy soils at Site A being captured on 8 occasions and only once at Site B on the clayey soils.

Nearly three times as many *Cercartetus concinnus* were caught at Site B. This may be attributed to the vegetation being unburnt for 50 or more years, with the dense *Dryandra tenuifolia* and *Dryandra armata* spreading to 1.5 metres in diameter. These dense mature shrubs and the thick grass skirts of *Xanthorrhoea preissii* probably offered shelter and

nest sights to a number of vertebrates.

Of note were the lack of snakes captured. The only snake sighted while undertaking the survey was an individual *Notechis scutatus* near Site B. In six years, single individuals of *Morelia spilota, Notechis curtis* and *Pseudonaja affinis* have been the only snakes sighted near the residence at the Bluff Knoll turn-off.

CONCLUSION

Of the 29 species of frogs, reptiles and mammals captured, 6 had not been recorded for the Stirling Range National Park before this survey was undertaken (see Table 1).

Population levels of the unique *Tarsipes rostratus*, which relies solely on nectar for its food, may decline through droughts when plants produce little or no flowers and from the loss of many nectar rich plant species through dieback disease caused by *Phytophthora cinnamomi.*

During this survey, rainfall apparently had an effect on animals capture rates, with much reduced capture rates during drought conditions compared with a period of average to above average rainfall. Conducting a survey during a drought would result in incorrect assessment of the conservation values of the area being sampled. While undertaking a pit-trap survey it is imperative that average rainfall and current rainfall for the study site be determined.

ACKNOWLEDGEMENTS

I thank Ron Johnstone and other staff of the Western Australian Museum for identification of specimens and printouts of all Western Australian Museum fauna for the Stirling Range National Park. Gordon Friend, Department of Conservation and Land Management provided technical assistance and commented on the manuscript. Allan Burbidge, Department of Conservation and Land Management commented on the manuscript. My wife Sandy commented on the manuscript and showed great patience during the survey.

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